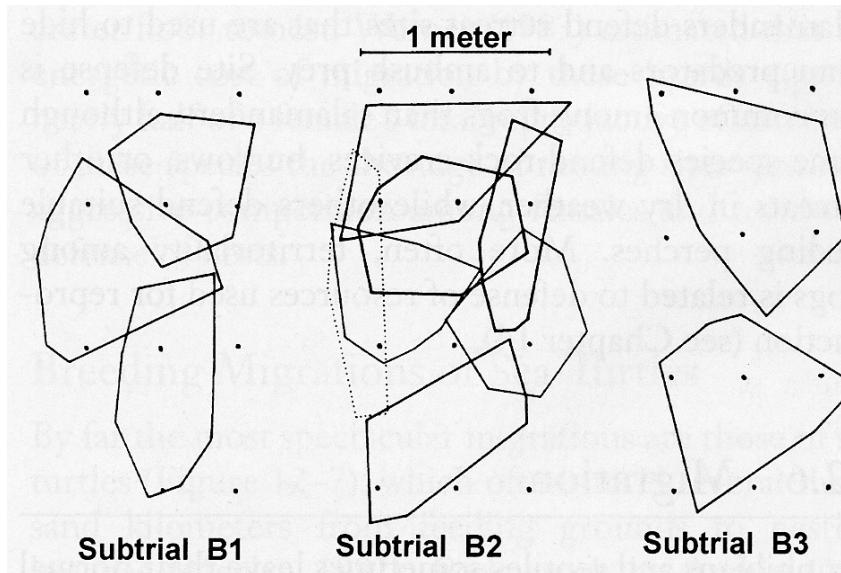


Spatial Ecology



Movement

- Foraging modes
- Types of movement
 - Local movements and home range
 - Territoriality
 - Migration
- Navigation

Movement

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Foraging Modes in Herps

- Sit-and-wait foraging
 - Searching: low energy
 - Capturing: high energy
 - Sit and wait for prey to come
- Active foraging
 - Searching: high energy
 - Capturing: low energy
 - Move about constantly in search of prey

Foraging Modes in Herps

- Sit-and-wait foraging
 - Cryptic
 - Low endurance, high anaerobic peak
 - Territorial
- Active foraging
 - Fast escape or toxic
 - High aerobic endurance
 - Not territorial

Foraging Modes in Herps

- Active foragers

“Scleroglossans”

- Sit-and-wait foraging



Cnemidophorus gularis



Anolis lemurinus

Iguanians

Foraging Modes in Herps

- Some of the characteristics of the two foraging modes may be related to their ecological consequences
- Others may be traits associated with major clades



Cnemidophorus gularis



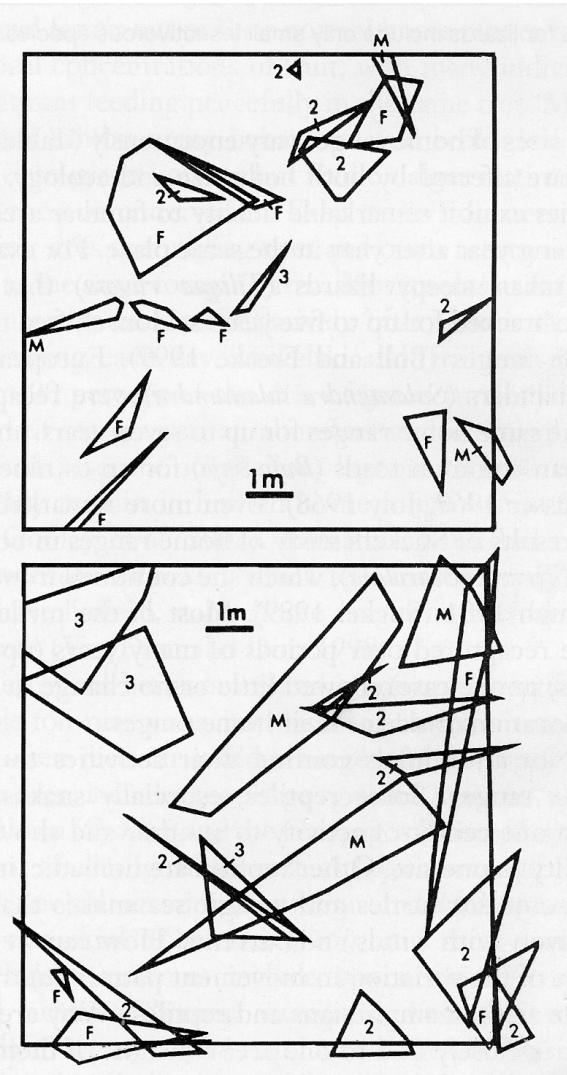
Anolis lemurinus

Movement

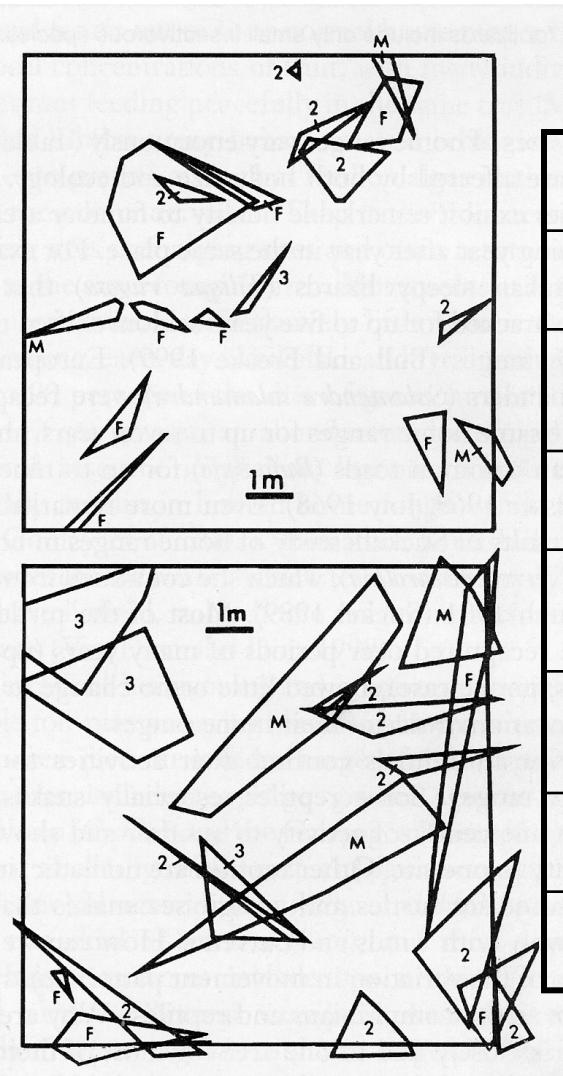
- Foraging modes
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Local Movements

- Most amphibians and reptiles spend much of their time in a “home range”
- **Home range:** the area that an animal traverses in the scope of normal activities
- Often estimated using the minimum convex polygon method



Home ranges of
Plethodon teyahalee
in two types of
habitat



Home ranges of
Plethodon teyahalee
in two types of
habitat

Group	n	Range (m ²)	Median (m ²)
Snakes (Colubridae)	17	9-210,000	6500
Snakes (Viperidae)	6	800-60,000	4900
Turtles (freshwater)	8	500-210,000	4000
Lizards (small male insectivores)	15	12-20,000	730
Lizards (small female insectivores)	10	15-1000	450
Anurans	21	1-1900	40
Caudata	13	0.1-87	4

See text for references



Area = 200,000 m²



$$\text{Area} = 0.1 \text{ m}^2$$

Not all animals have “homes”

- Small home range
 - Abundant resources
 - Evenly distributed
 - Quickly renewed
- Large home range
 - Variable abundance
 - Patchy distribution
 - Slow renewal
- Nomadic
 - Low abundance
 - Very patchy distribution
 - Slow or no renewal

Not all animals have “homes”

- Small home range



Bog turtle *Glyptemys muhlenbergii*

- Large home range

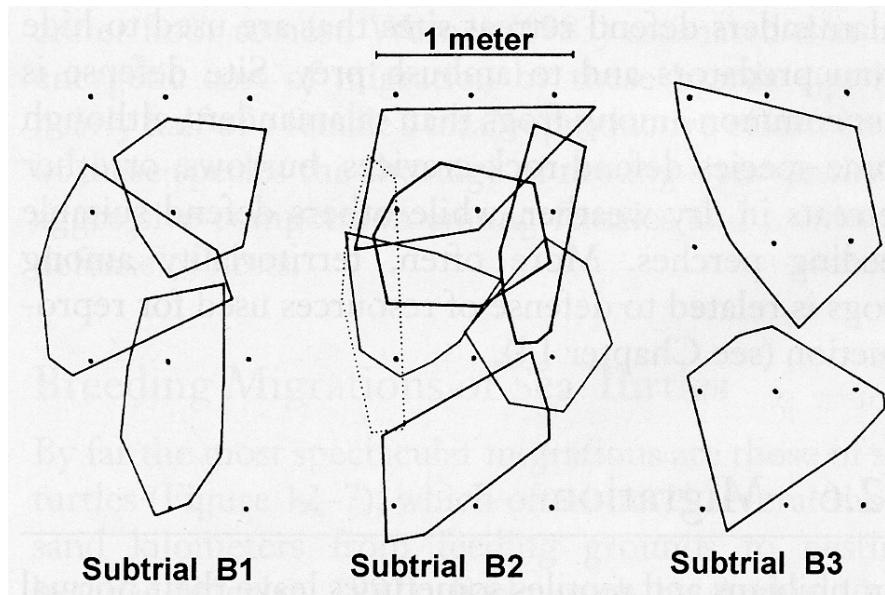


Black rat snake *Elaphe obsoleta*

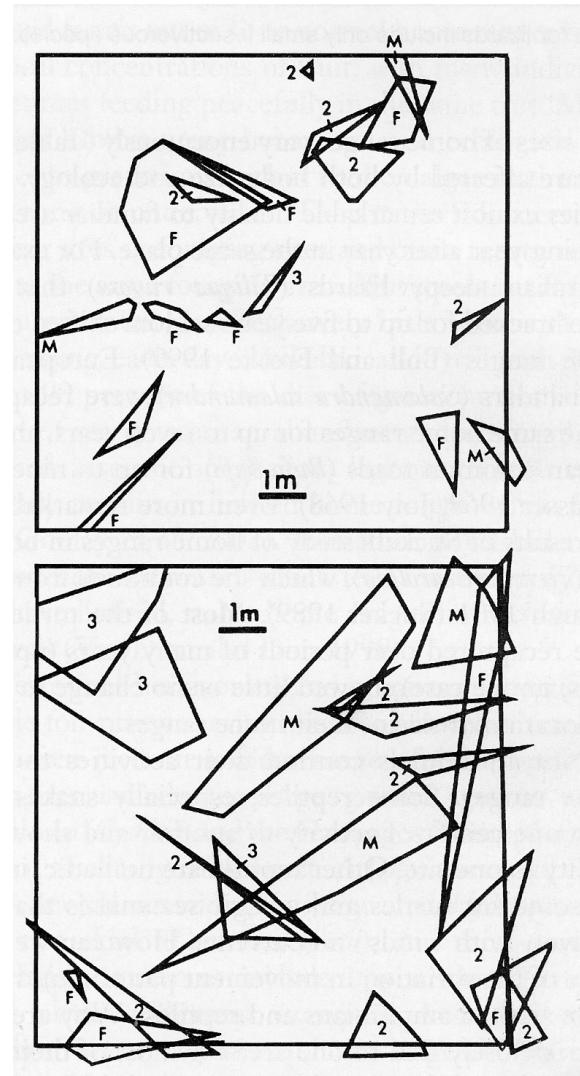
- Nomadic



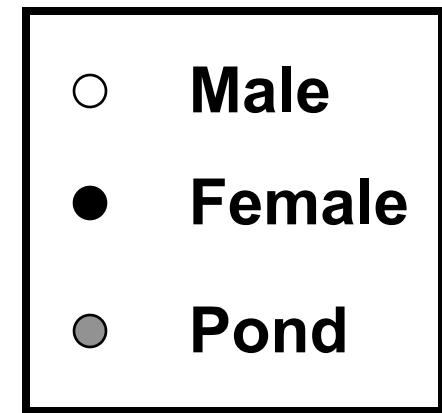
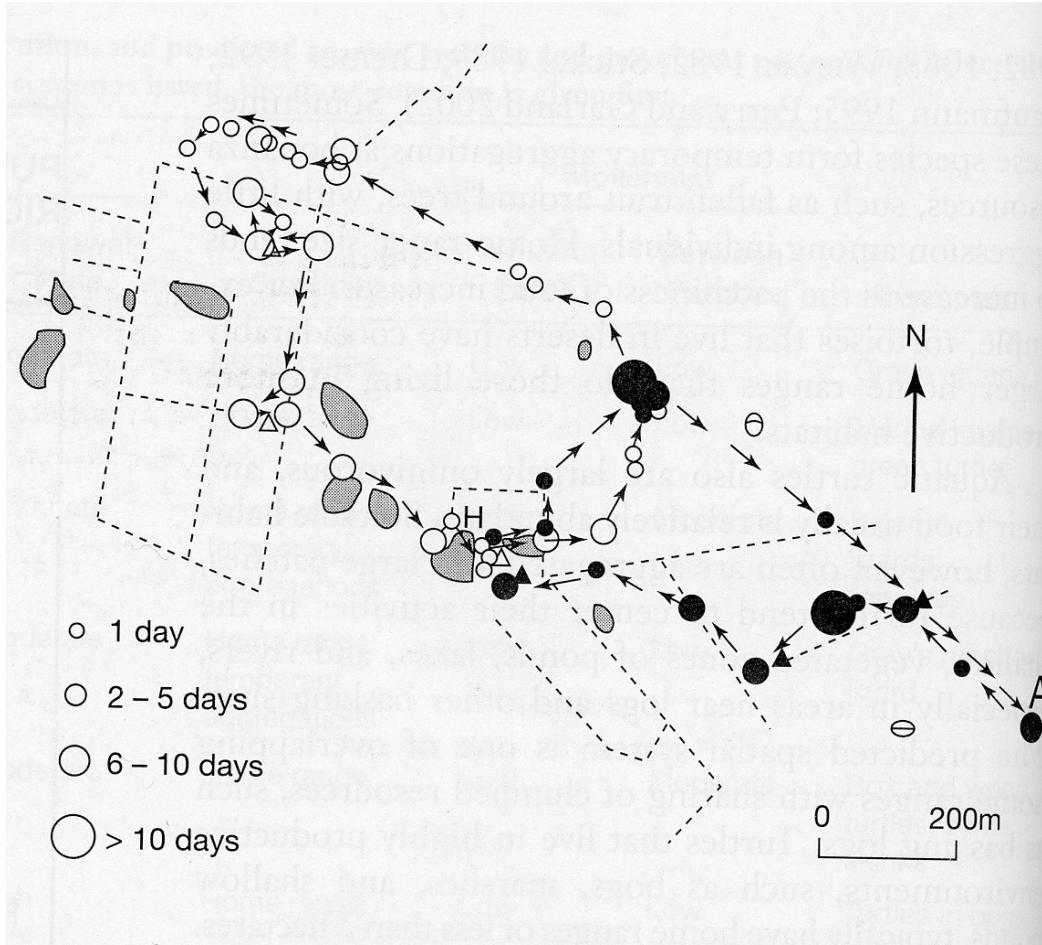
Leatherback Turtle (*Dermochelys coriacea*)



Home ranges of juvenile
Anolis aeneus in
experimental patches



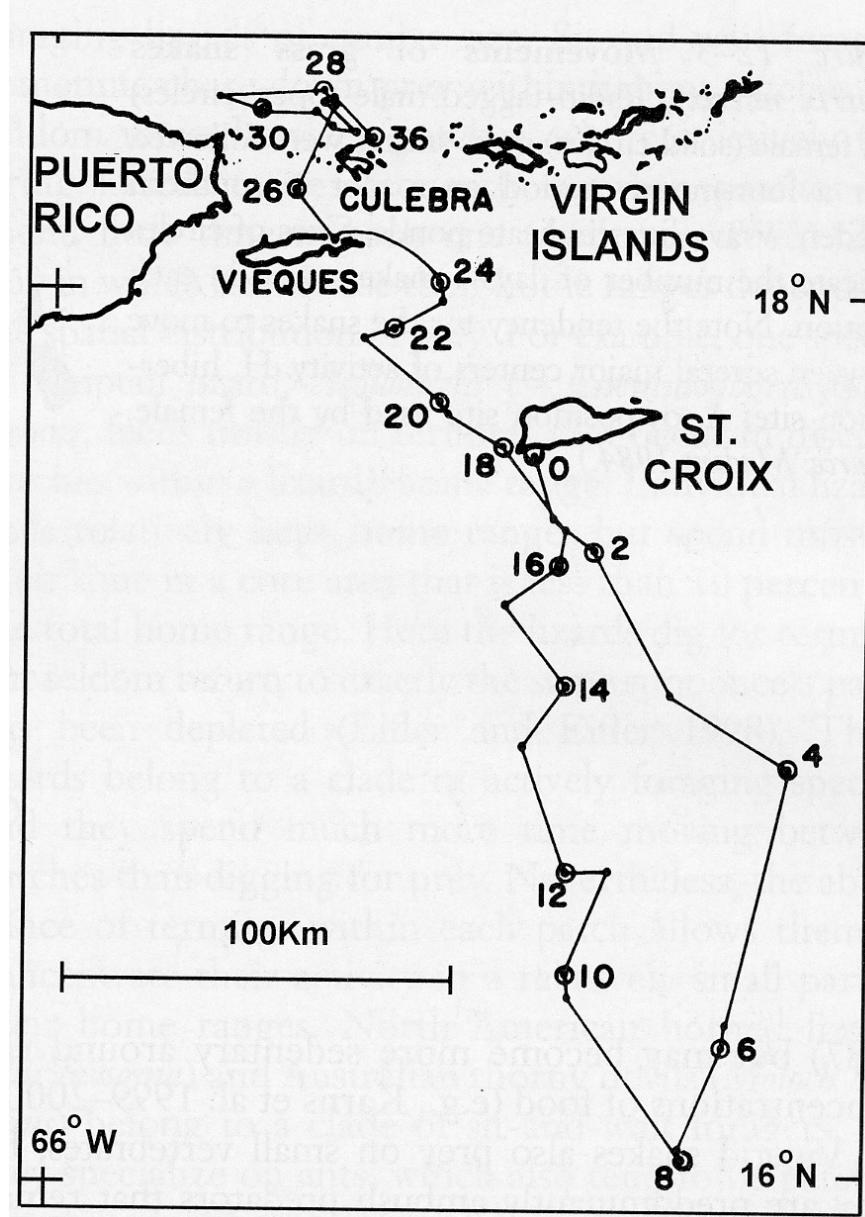
Home ranges of
Plethodon teyahalee
in two types of
habitat



Movements of male and female grass snakes (*Natrix natrix*) over 4 months in Sweden

Movement of a
female leatherback
turtle over an 18
day period
(Keinath and
Musick 1993)

> 512 km



Territoriality

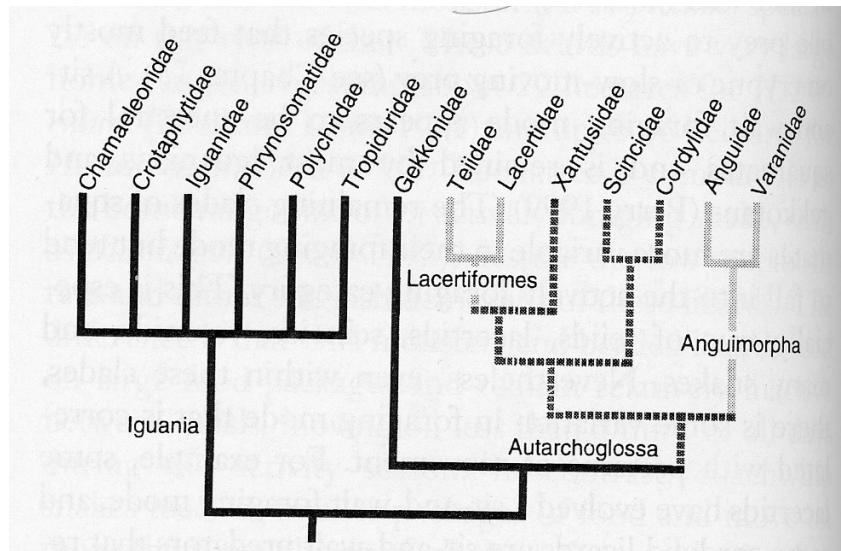
- Territoriality: aggressively defending all or part of a home range
- Cost: energy for defense
- Benefit: don't have to share depletable resources

Territoriality

- Favored when resources are:
 - Moderately abundant
 - Even or moderately patchy distribution
 - High renewal rates
- Some animals are territorial only in certain times or places

Territoriality

- Common in sit-and-wait insectivores
 - Iguanians
 - Geckos
 - Some other scleroglossans



Territorial Behavior

- Mates, not food, might be the key resource
- Often only the males are territorial
- Aggressive encounters common among males, increases during breeding

Migration

- Three main reasons for adult migration:
 - Seasonal habitat changes
 - Breeding
 - Hibernation
- Juvenile migration is common

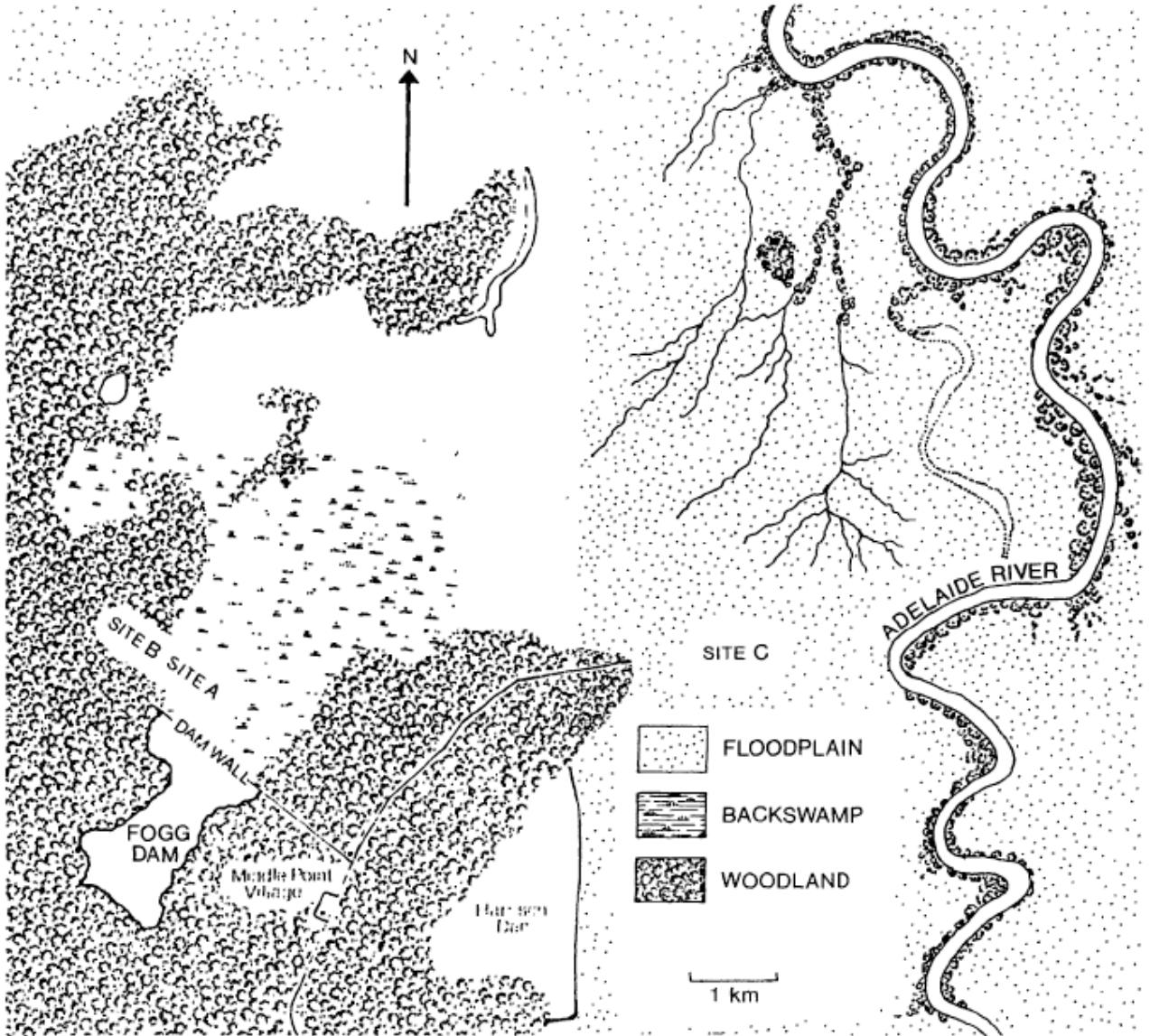


FIG. 2. Map of study area, showing vegetation types and rat-trapping sites (Site A, B, and C).

- Dry season
- Wet season

Seasonal movement in Australian water pythons (*Liasis fuscus*)

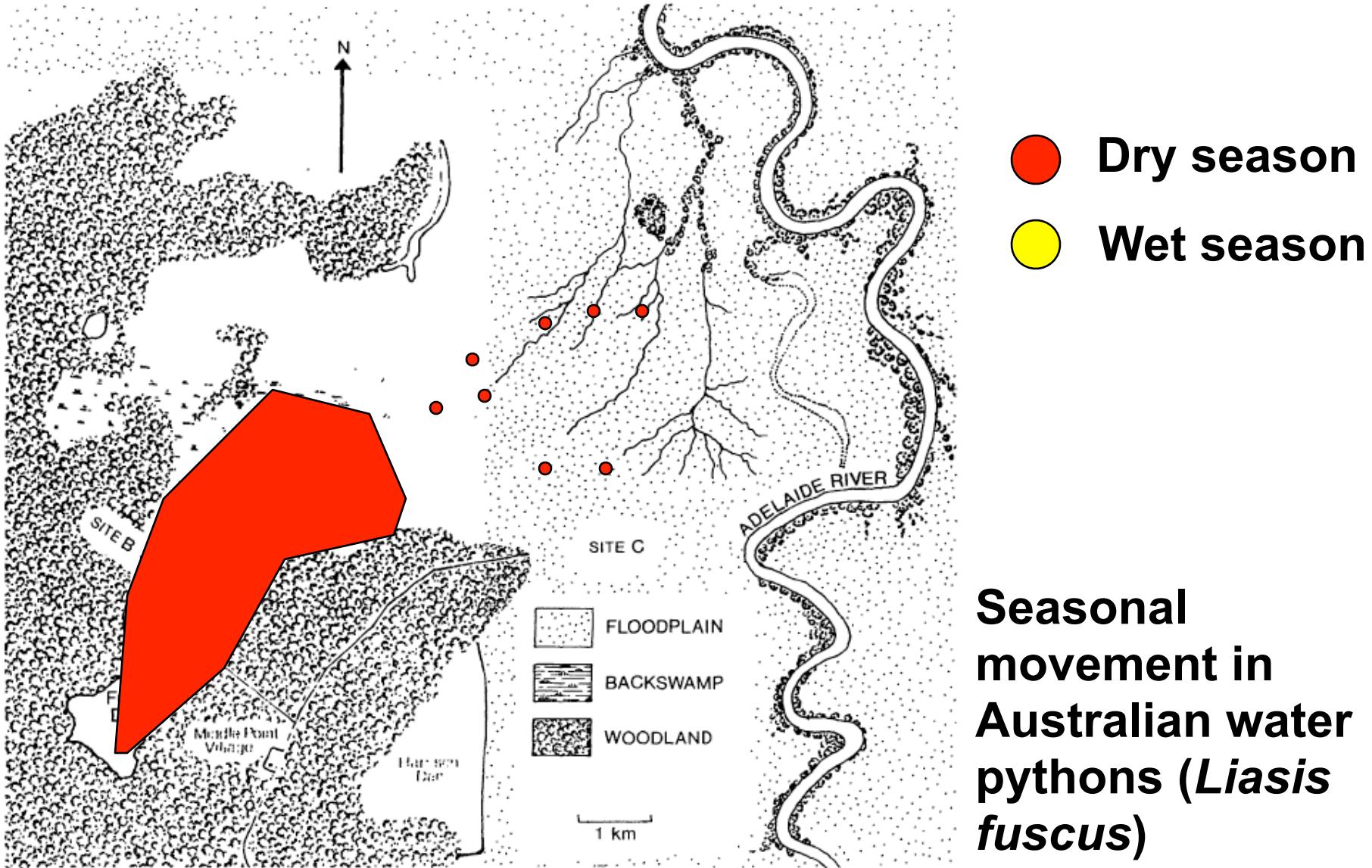


FIG. 2. Map of study area, showing vegetation types and rat-trapping sites (Site A, B, and C).

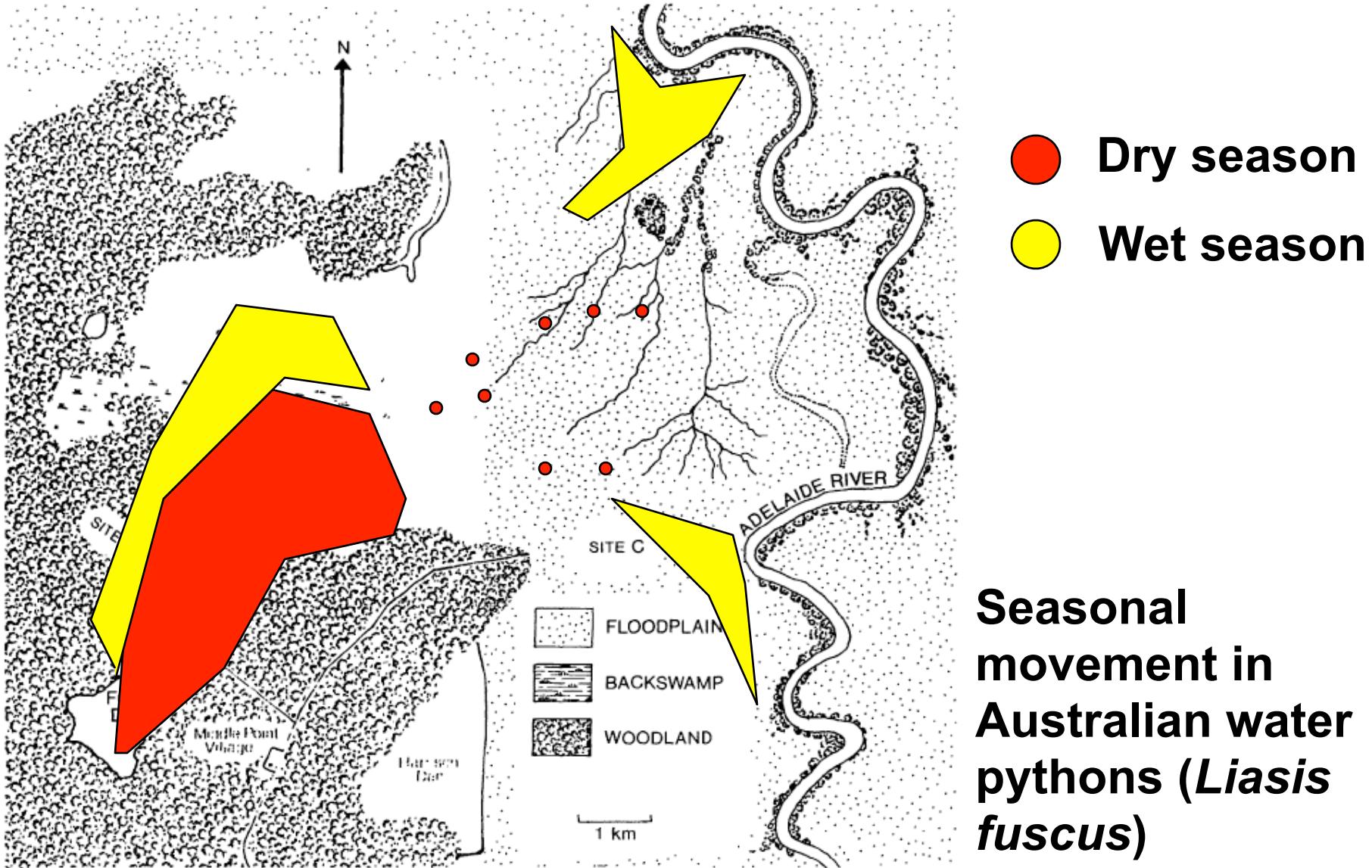
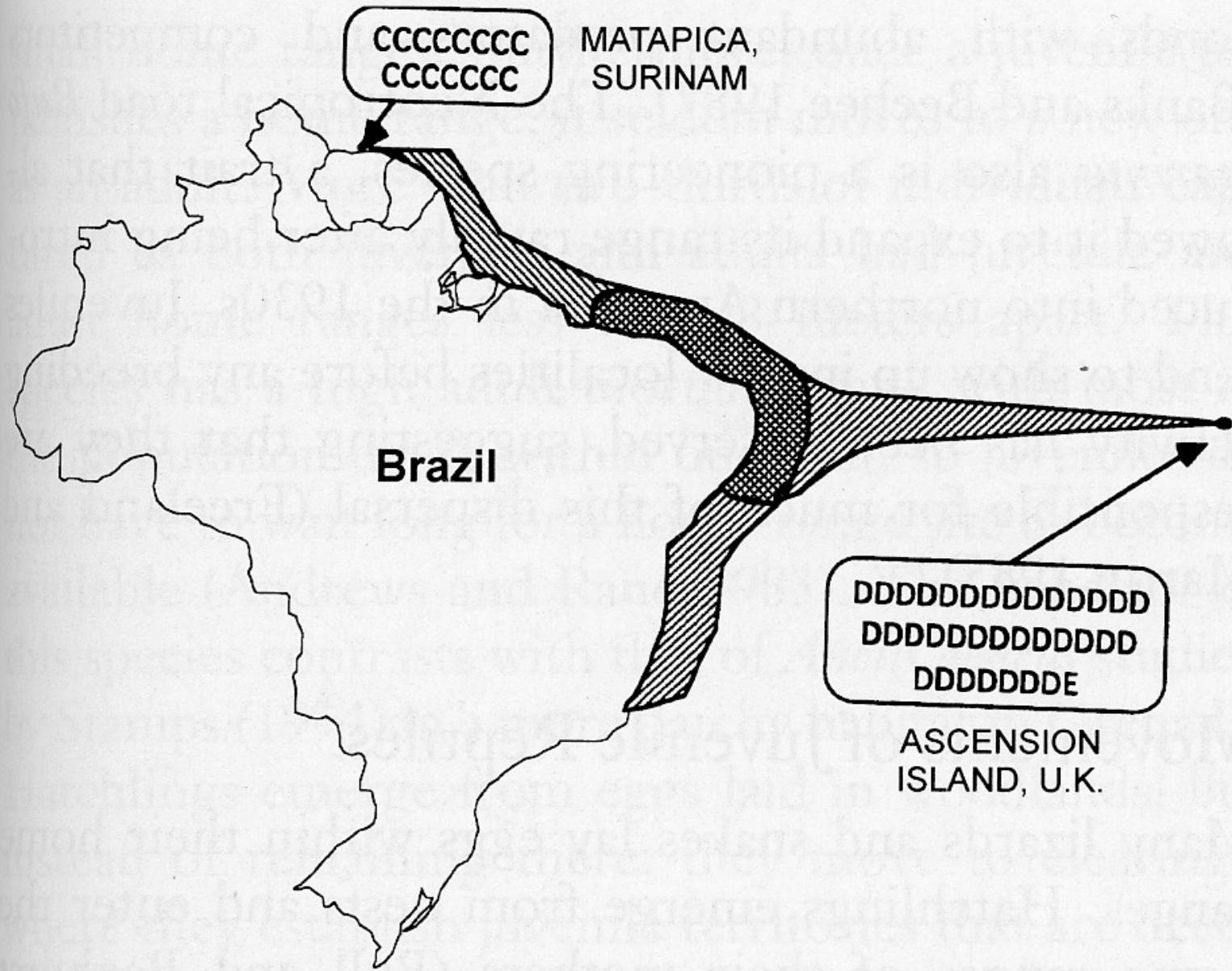
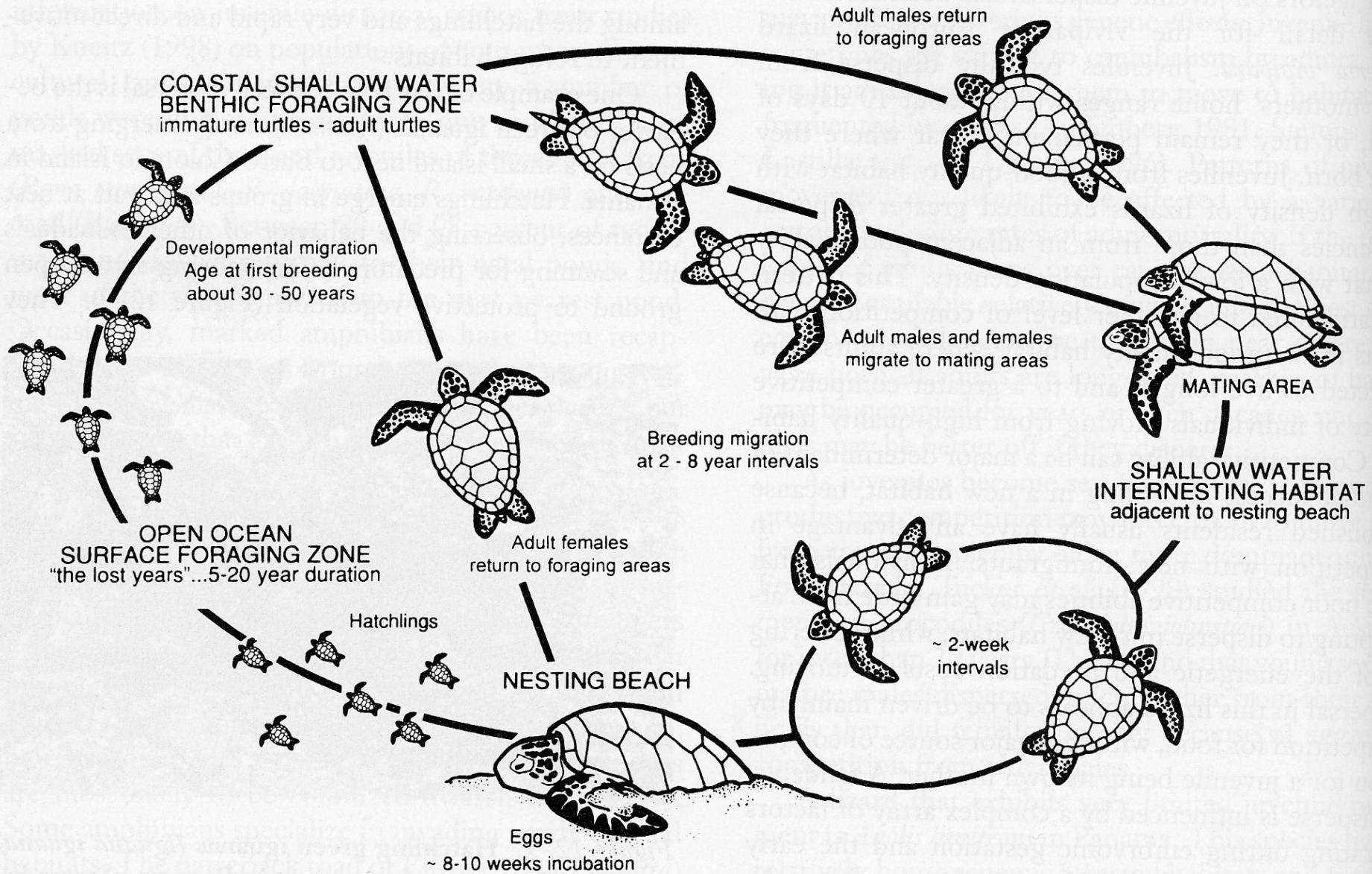


FIG. 2. Map of study area, showing vegetation types and rat-trapping sites (Site A, B, and C).



Juvenile Migration

- Juveniles frequently leave the areas where they are born
 - Juveniles and adults use different habitats
 - Find patches unoccupied by adults
 - Avoid cannibalism
- New habitats are frequently colonized by juveniles

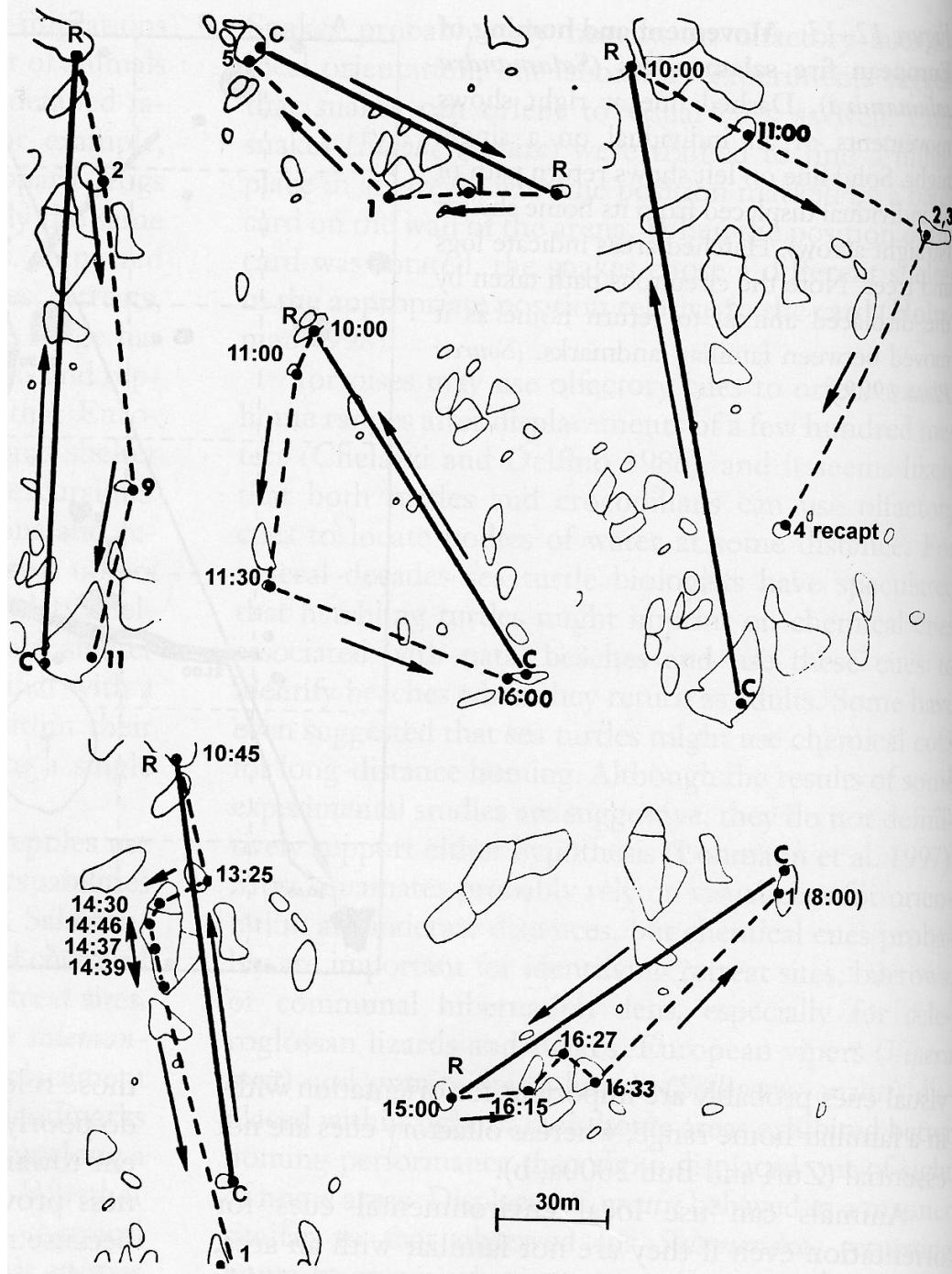


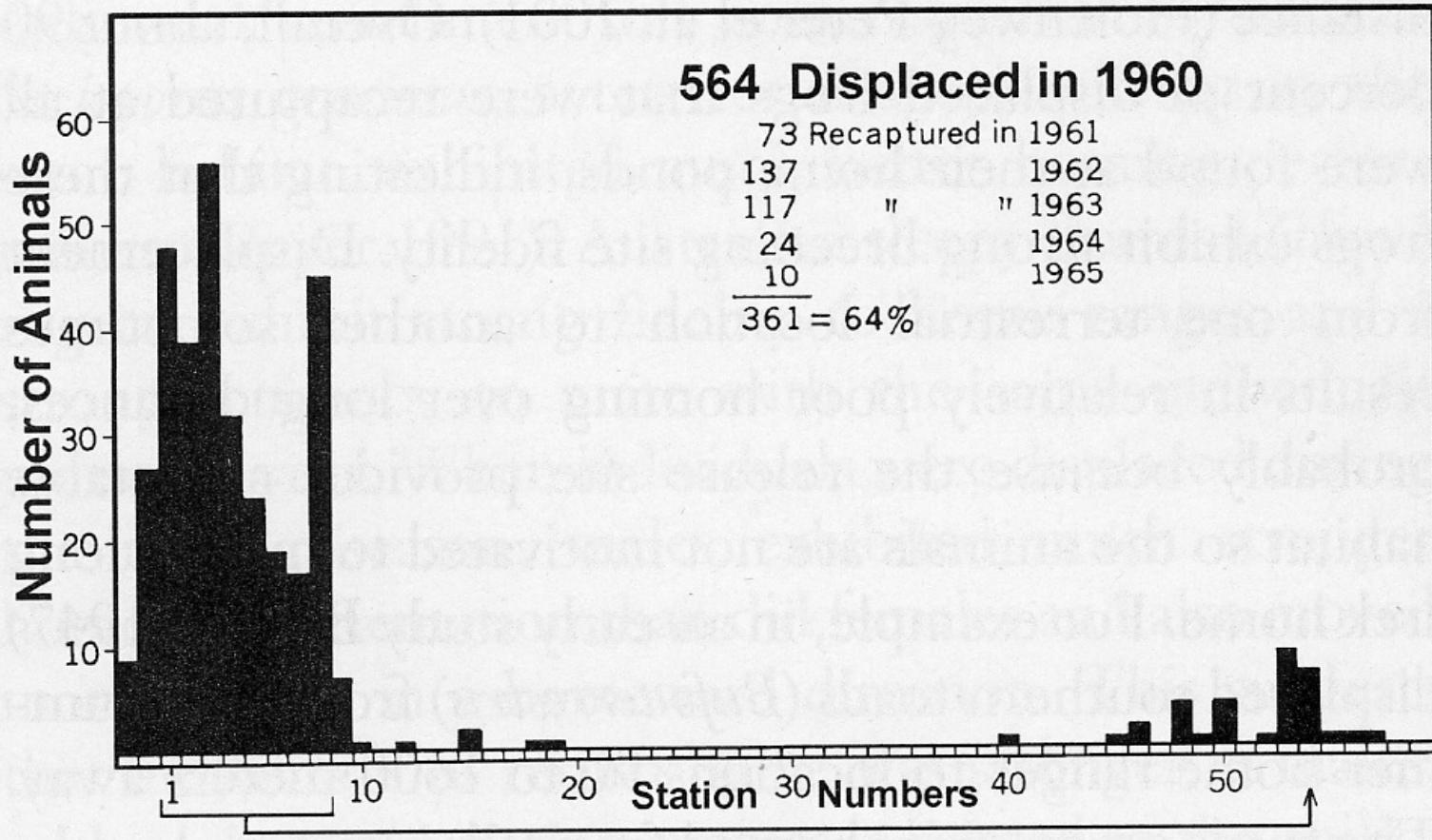
Life cycle of *Chelonia mydas*

Navigation

- How do reptiles and amphibians find their way back home again?
- Species can be quite good at finding where they want to go

Homing by *Sceloporus* *orcutti*





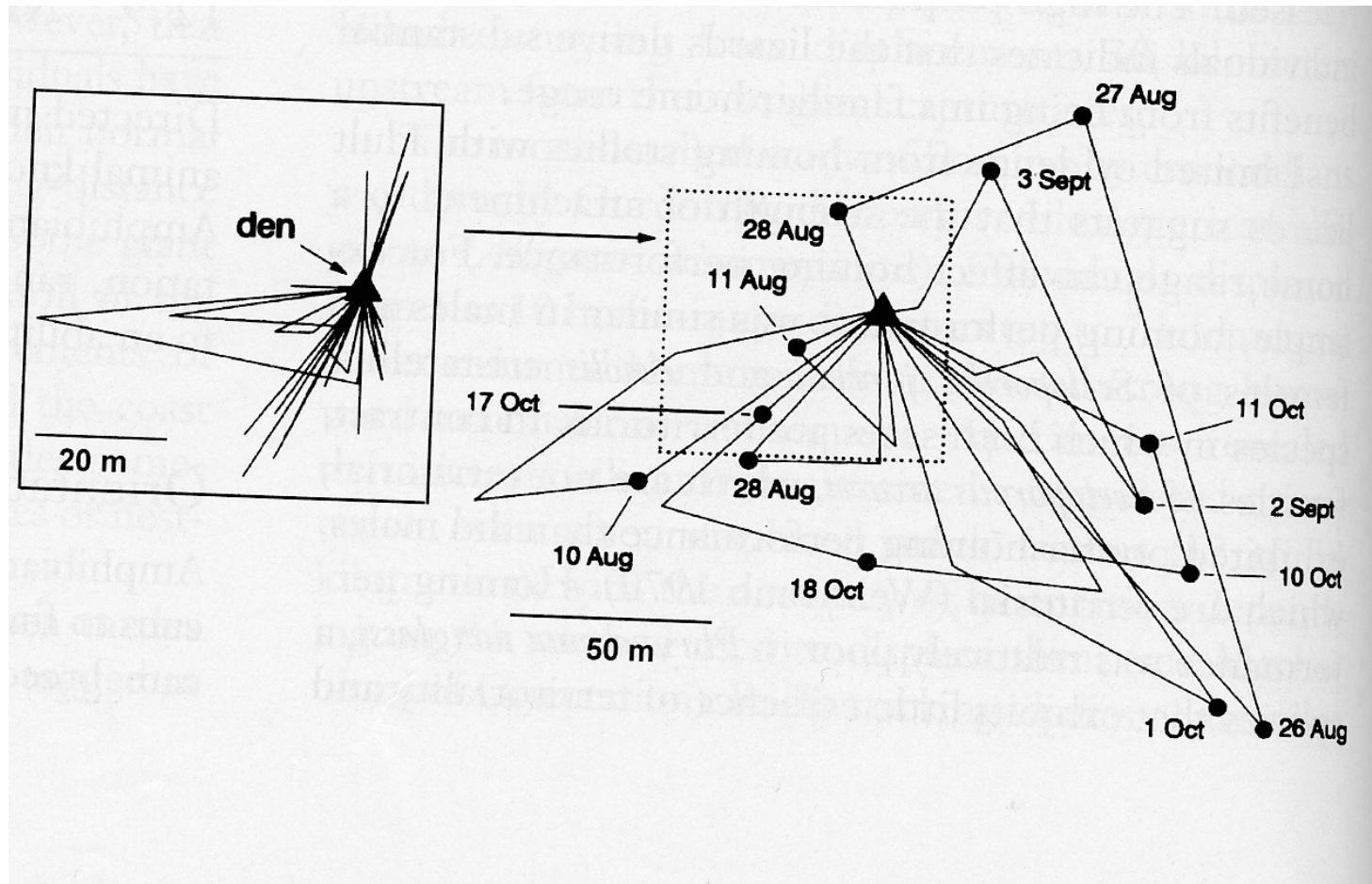
Homing of displaced newts (*Taricha rivularis*) in California

Mechanisms of Navigation

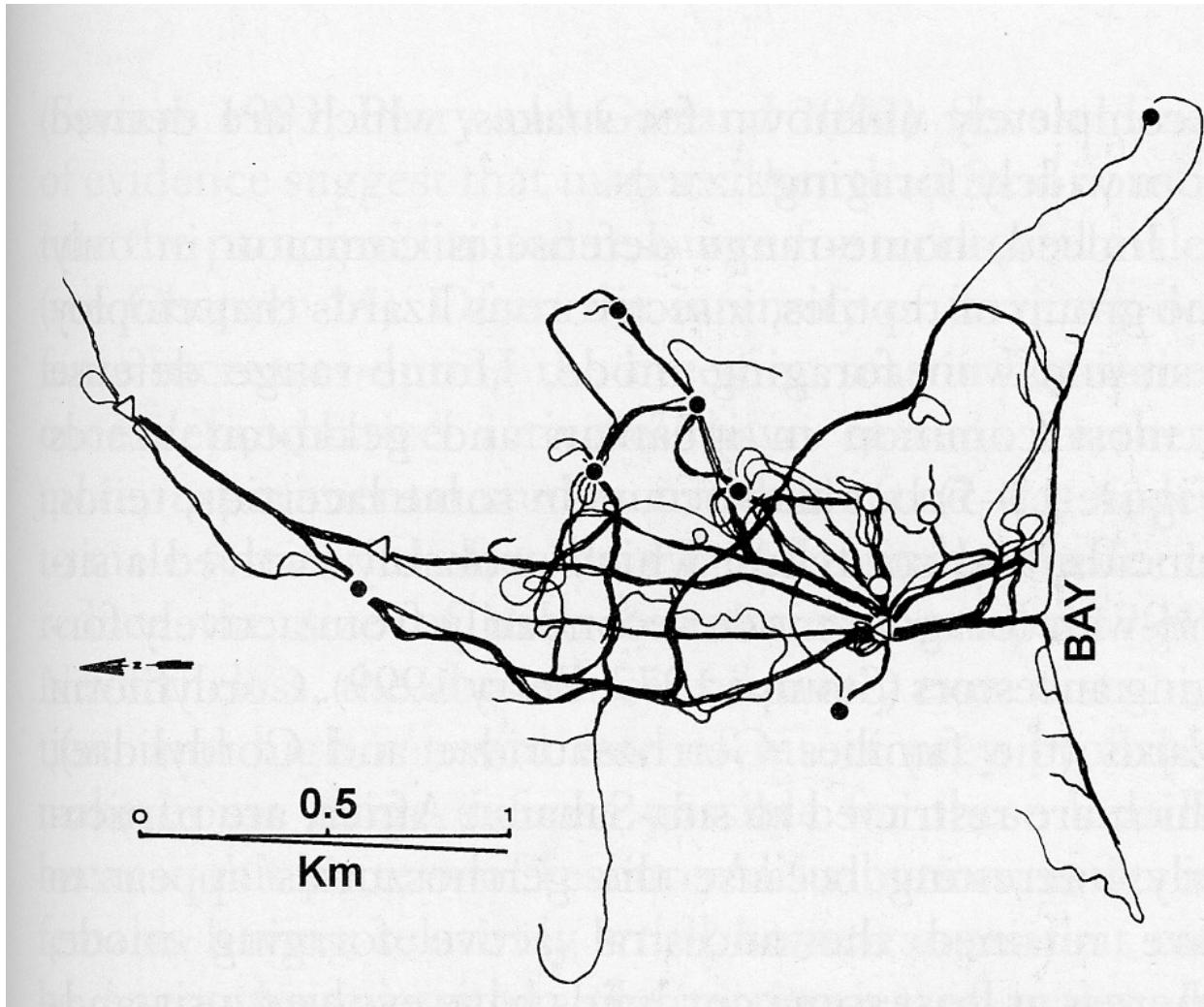
- Local environmental cues
- Compass orientation
 - Sun's position
 - Polarized light
- Magnetism

Mechanisms of Navigation

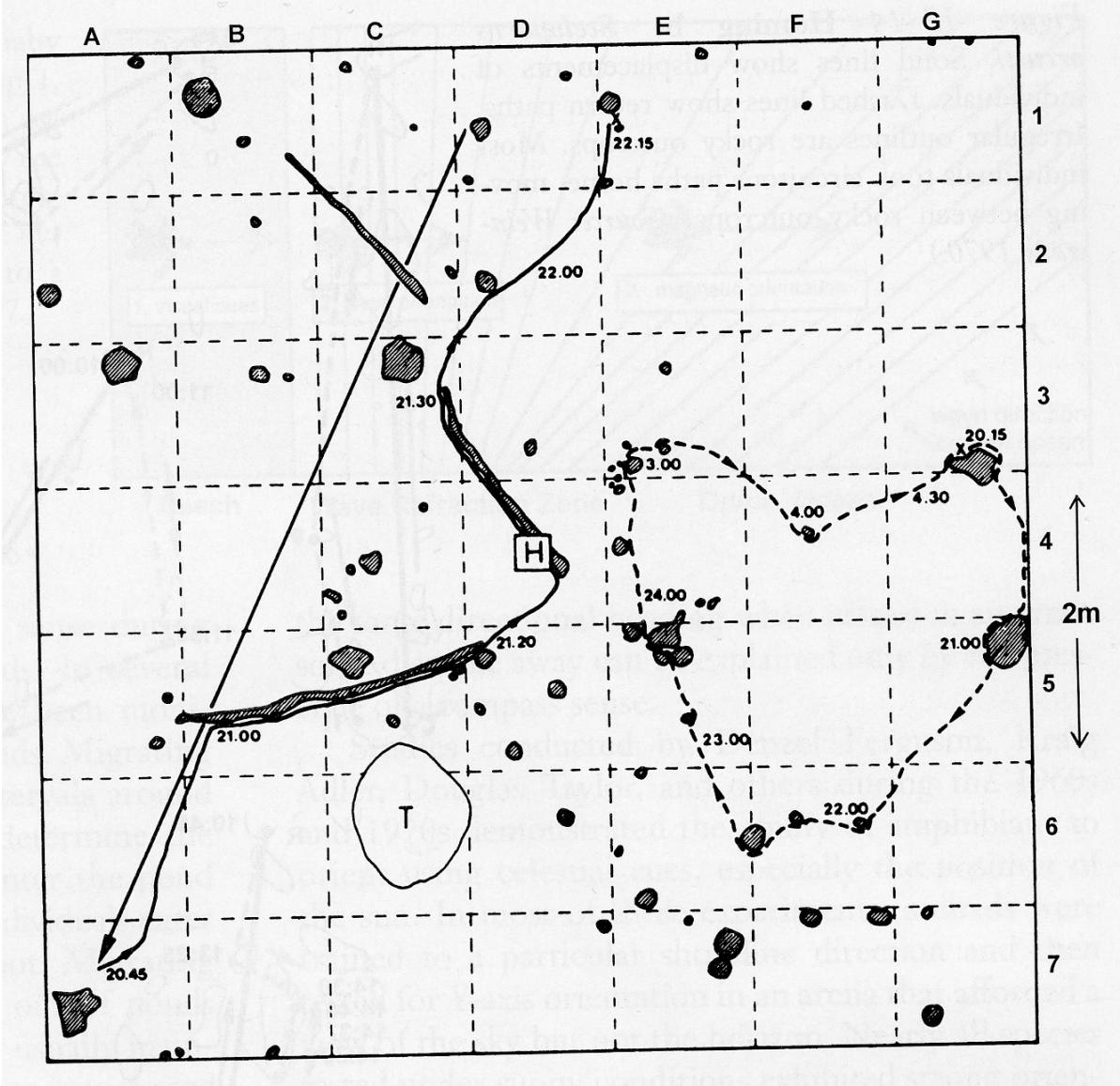
- Local environmental cues
- Compass orientation
 - Sun's position
 - Polarized light
- Magnetism



Pattern of movement of a European yellow-green racer (*Coluber viridiflavus*)



**Repeated use of the same pathways by
Komodo dragons, *Varanus komodoensis***



**Natural (dotted) and artificial homing
behavior in European fire salamanders
(*Salamandra salamandra*)**

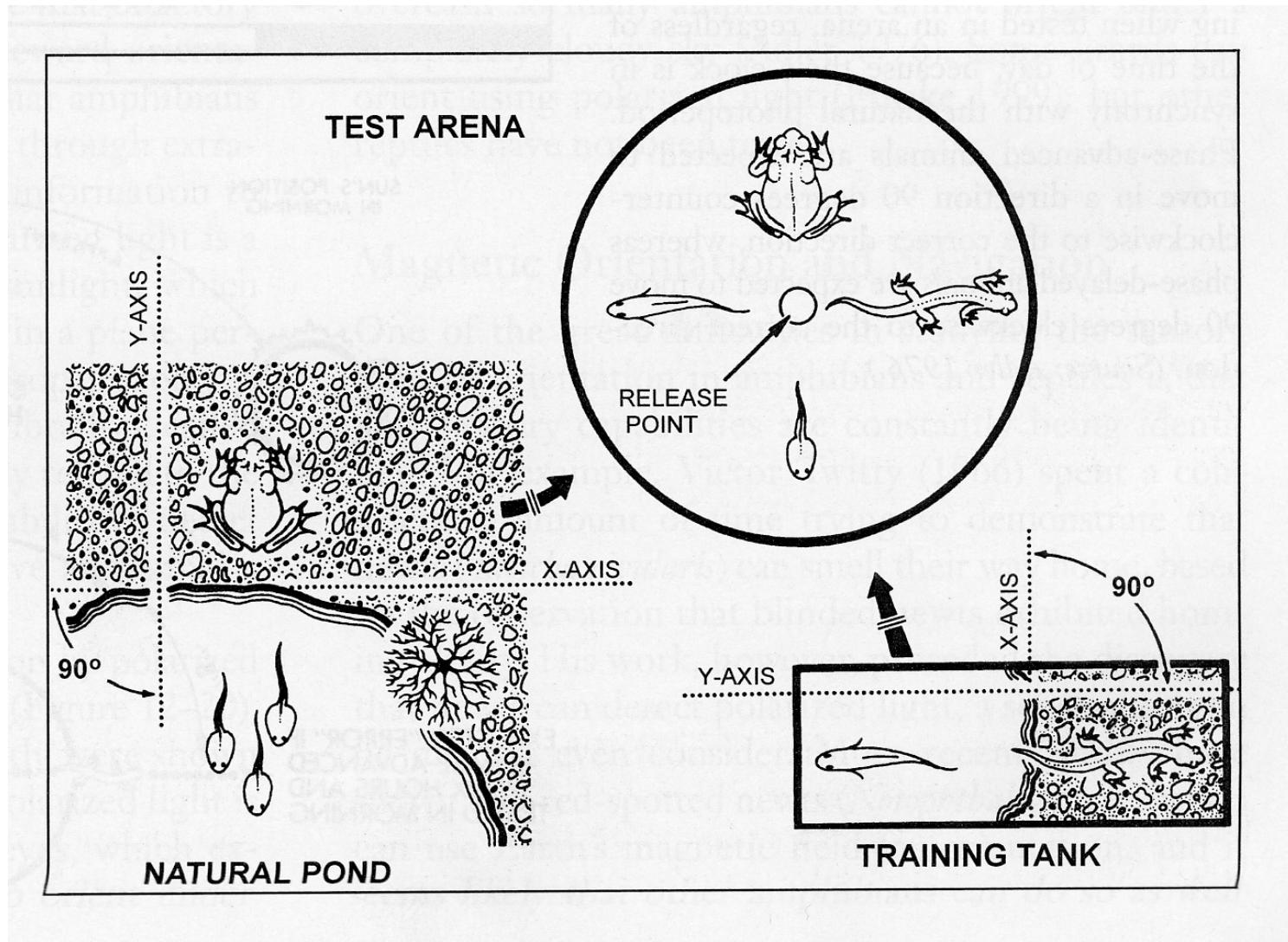
Local environmental cues

- Cues depend on sensory capabilities
- Examples:
 - Salamanders: chemosensory
 - Snakes: olfactory
 - Lizards: visual + olfactory
- Can use cues even in new places
 - Go downhill for water
 - Brightest area = sea

Mechanisms of Navigation

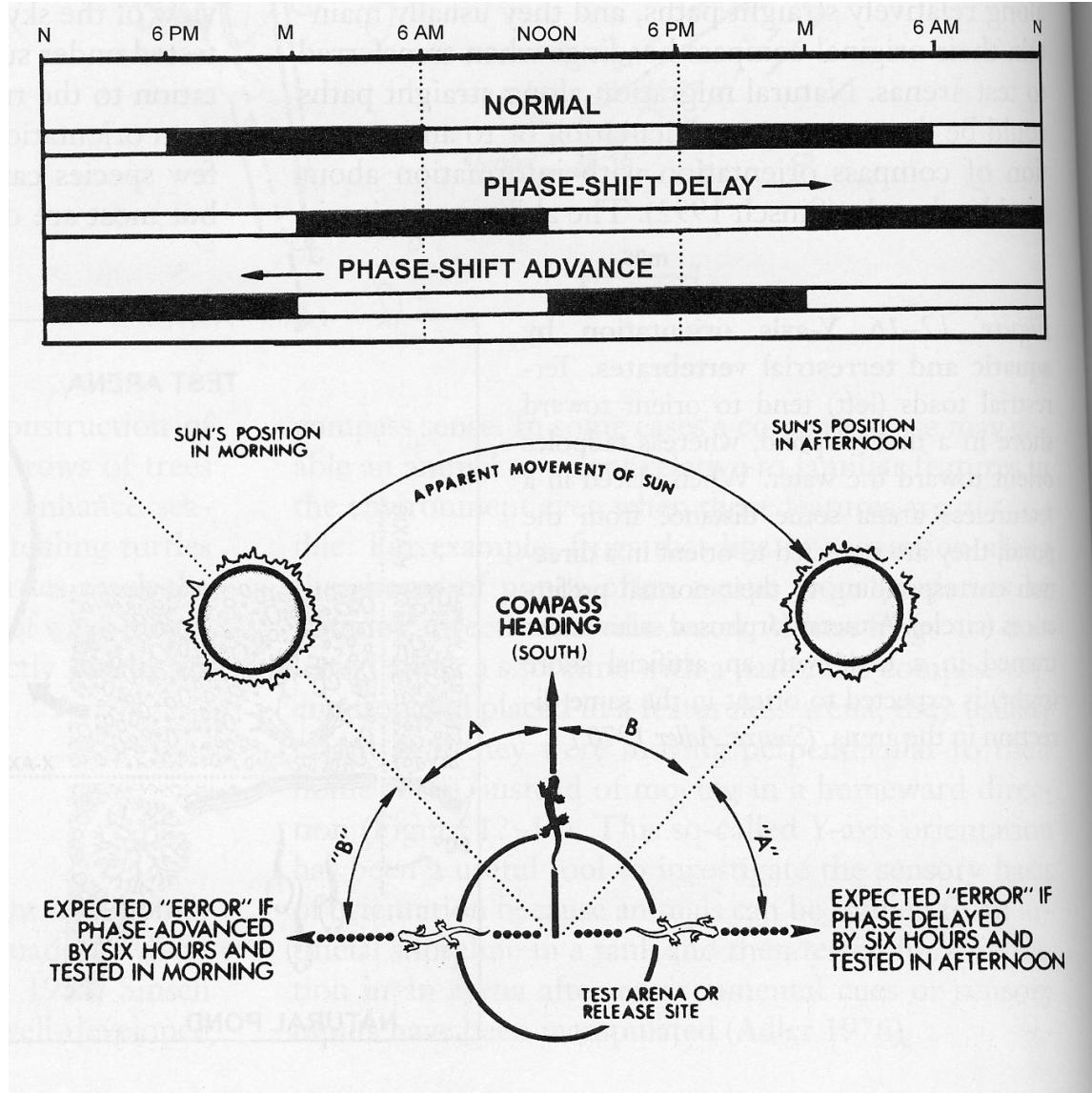
- Local environmental cues
- Compass orientation
 - Sun's position
 - Polarized light
- Magnetism

Y-axis orientation



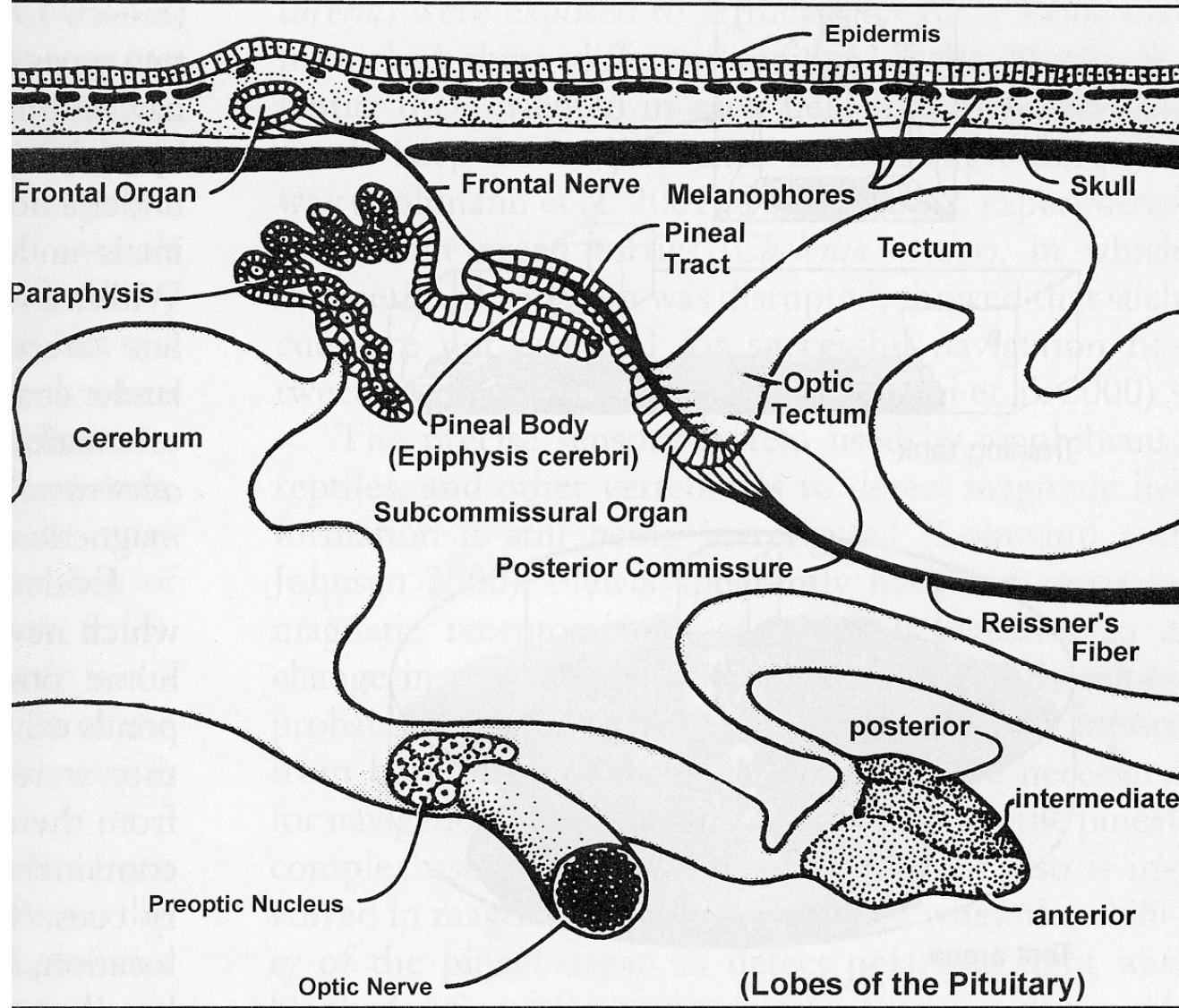
Celestial Navigation

- Y-axis orientation shows that animals have a compass sense
- Many amphibians lose orientation in overcast conditions
- Can compensate for annual movements of the Earth relative to the sun



Effect of clock shifting on a newt

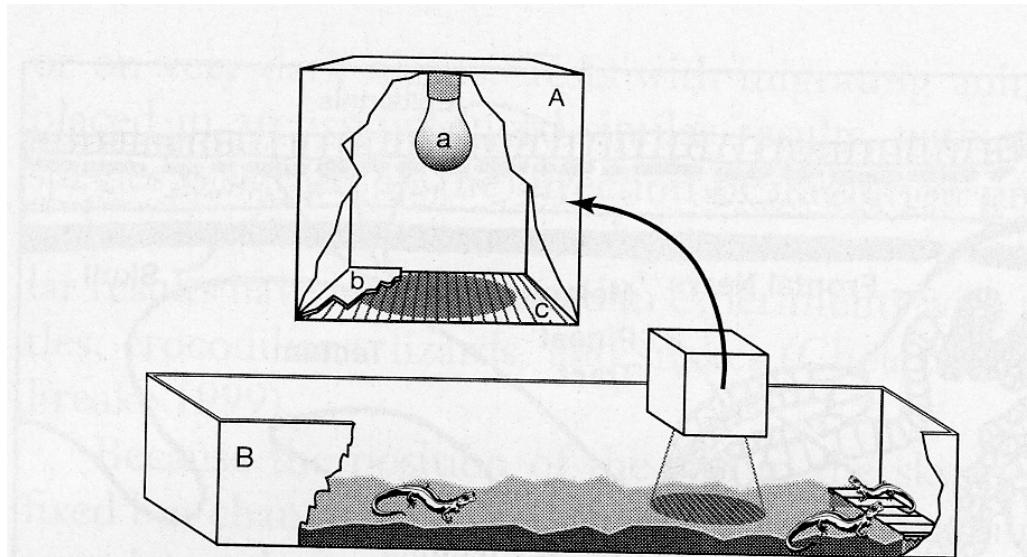
Pineal Complex of a Frog



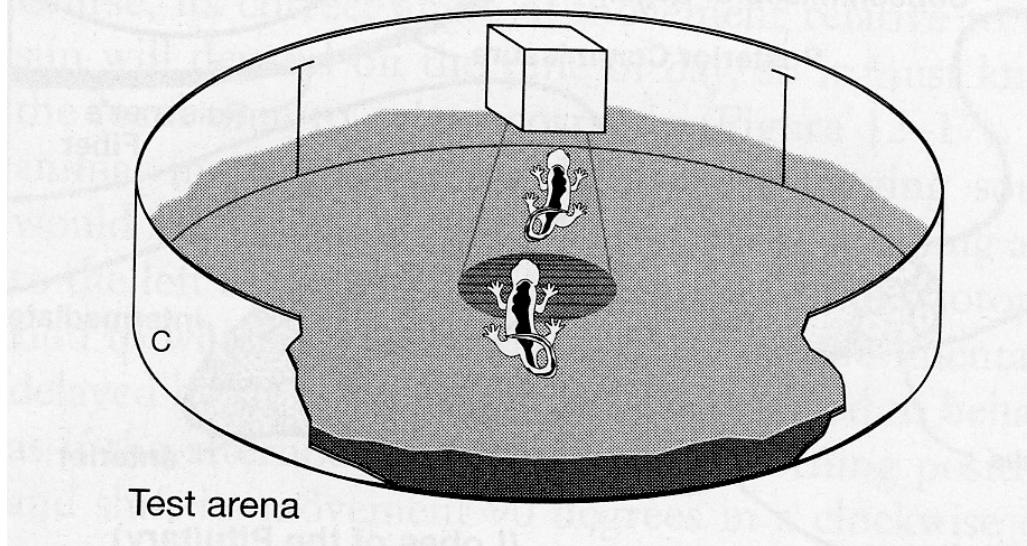
Polarized Light

- Pineal complex can also detect polarized light
- Can tell direction of sun
- May also aid in detecting large bodies of water

Polarized light training tank

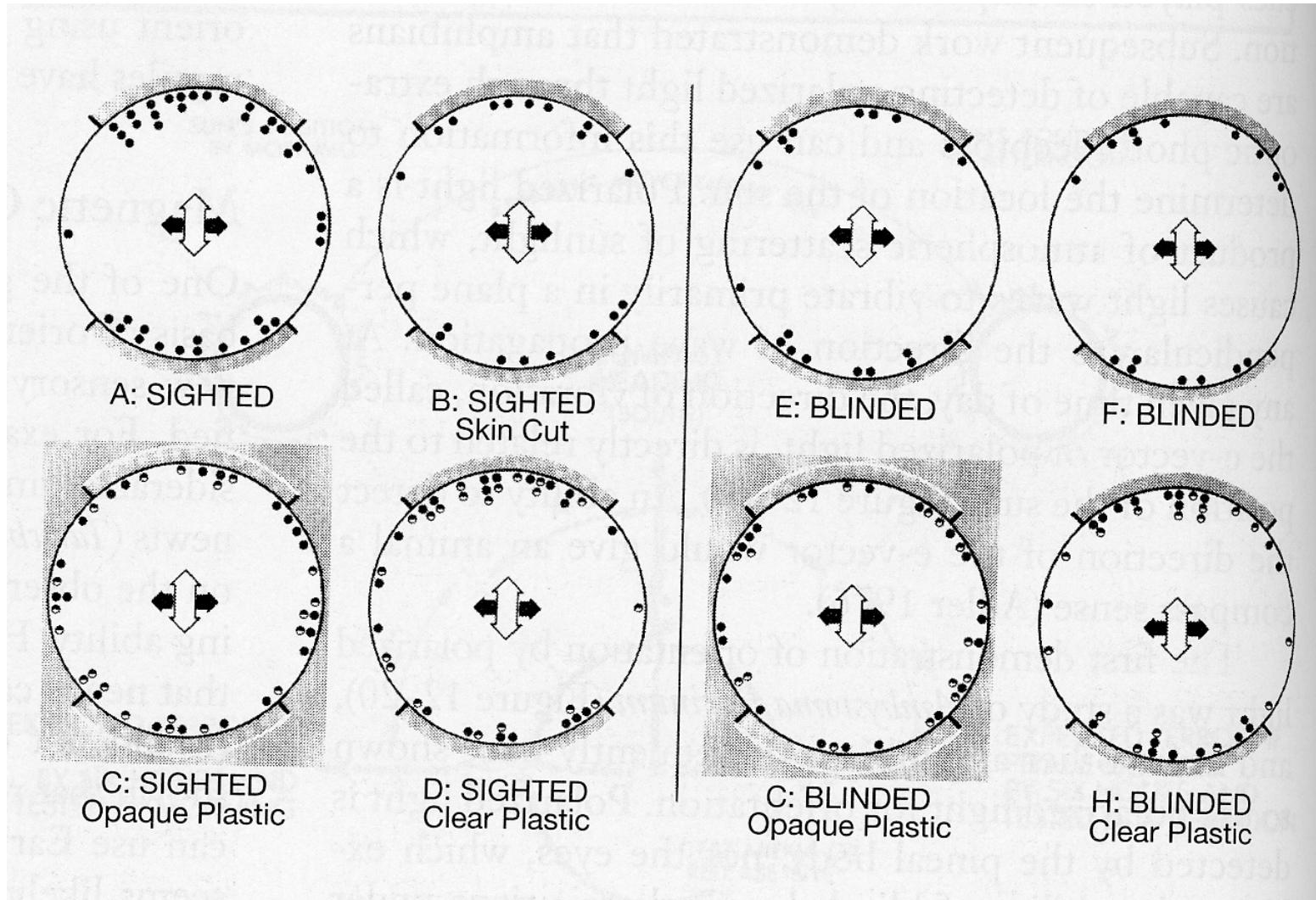


Training tank



Test arena

Polarized light orientation



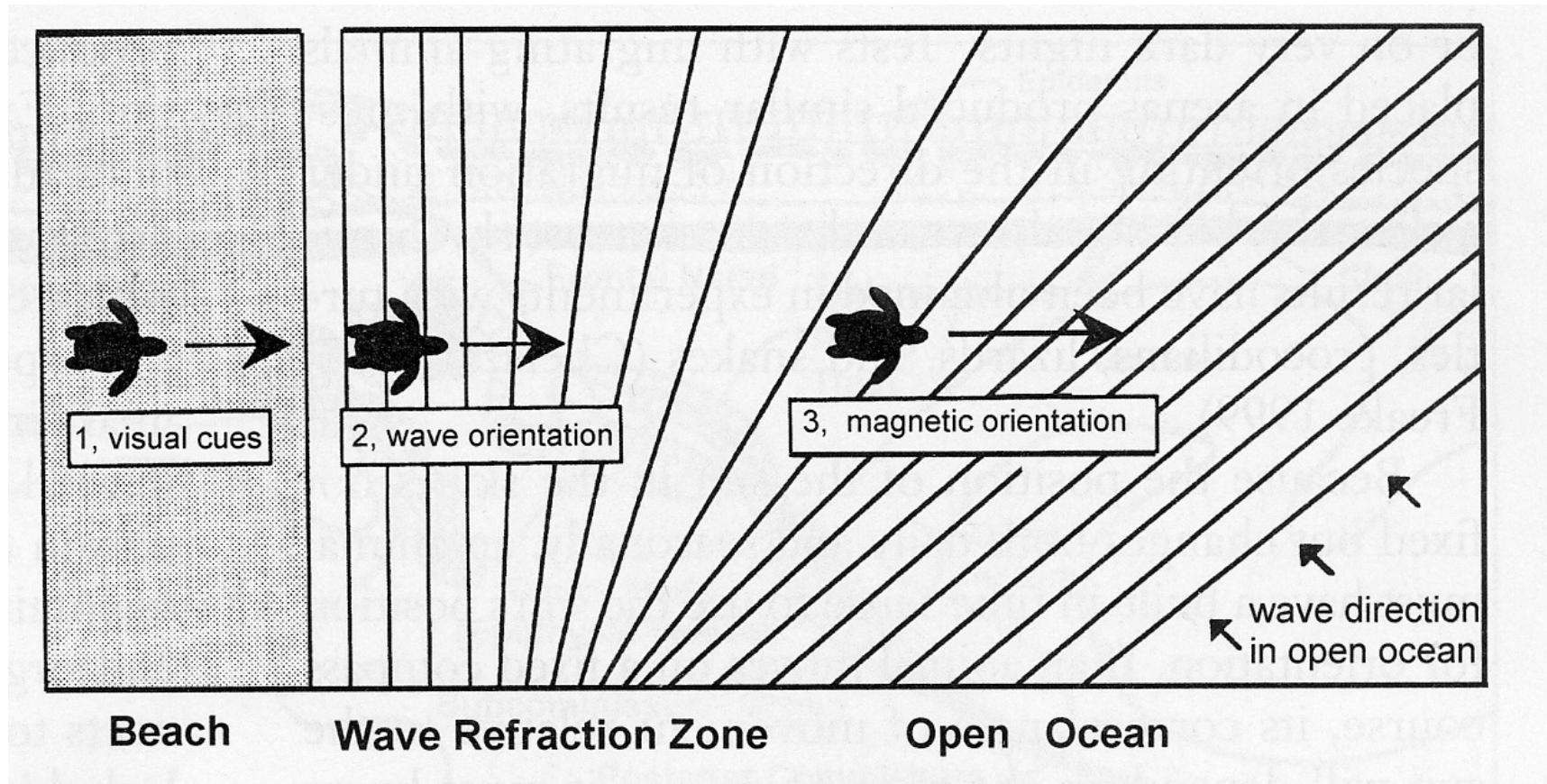
Mechanisms of Navigation

- Local environmental cues
- Compass orientation
 - Sun's position
 - Polarized light
- Magnetism

Magnetic Navigation

- Has been shown in a range of species of reptiles and amphibians
- Example: newts collected and moved to a site 30 km away and indoors still orient correctly, unless magnetism changed
- Sea turtles may make a “magnetic map”

Combining Methods of Navigation



Movement

- Foraging modes
- Types of movement
 - Local movements and home range
 - Territoriality
 - Migration
- Navigation